



402 – IMAGE ANALYSIS

TEAM INFORMATION

Team Name:

AWGN

Results Email:

[Redacted]

Examination Time Frame:

10/1

to

10/25/08

INSTRUCTIONS

Description: Examiners must develop and document a methodology used to determine whether the images in the **402_Image_Analysis_Challenge2008** folder are real (digital image without modifications), digitally enhanced (real image that has been modified), computer generated (CG), or a composite image (containing both real and CG elements). You will be expected to identify the nature of each picture. Please tell what you believe is the nature of the picture (real, composite, enhanced, CG... etc.)

Points will be awarded for each successfully identified image provided you supply a detailed methodology of how you derived your conclusion. The more information you can provide the better. If you think something looks real (or fake) but can't develop an algorithm, just do your best to describe what it is you're seeing.

What kind of images are in the challenge?

- I. Real unmodified digital images
- II. Real images that have been modified in some way (airbrushed, redeye corrected, cropped, etc)
- III. Composites (combo of several images). Elements of the image can be real, fake, or both)
- IV. Computer Generated images

Total Weighted Points: 20 Total Points available per entry – Total 400 Points Available

1. **Answers** – Circle Real, Enhanced, CG, or composite below. *As a Forensic Challenge, consider that your answers will have to have enough detail for the Findings and Methodology of your examination to satisfy questioning in a court of law.*
2. **Methodology** – Provide a meticulously detailed explanation of your process. Be sure to include a step action that our reviewers can follow to reproduce your work for authenticity including tools and techniques.

INTERNAL REVIEWER USE ONLY

Reviewer:

Points Awarded:

Date:

Review Period:

to

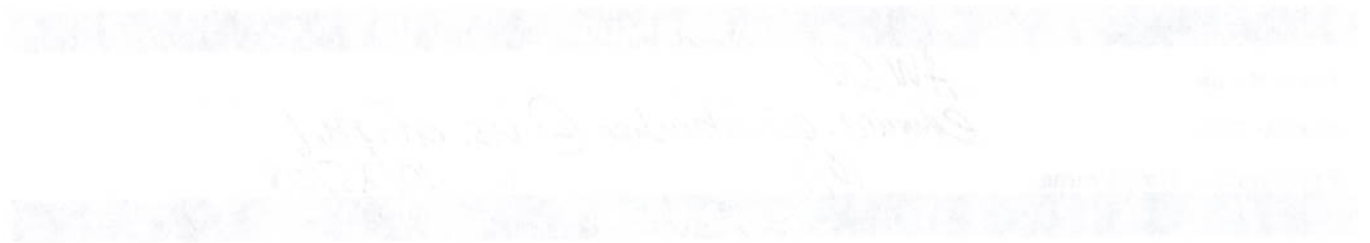
Completed: ☐ Yes

☐ No

☐ Partial

Team AWGN 402

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The first of the two main sections of the report is a detailed description of the current state of the world's oceans. This section covers a wide range of topics, including the physical characteristics of the oceans, the distribution of marine life, and the impact of human activities on the marine environment. The second main section of the report is a discussion of the challenges facing the world's oceans and the need for international cooperation to address these challenges.

The report also includes a number of recommendations for action. These recommendations are based on the findings of the report and are designed to help governments and other stakeholders to take effective action to protect the world's oceans. The report is a valuable resource for anyone interested in the state of the world's oceans and the need for international cooperation to protect them.

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Challenge Number: 402 - Image Analysis

Examiner: James Willmont, Graham Eschbacher



Keyboard.jpg - Real unaltered image

Canon Canon powershot G7 was located at 0X904 while looking at the Keyboard.jpg file in notepad++, which implies that the image is a real photo and not CG. The metadata says the image was taken at a lens apperture of F/2.8 which would be consistent with the depth of field of the image. The apperture setting could have caused the image to have out of focus areas. Additionally, used Error Level Analysis in two ways. Used Error Level Analyzer from http://www.tinyappz.com/wiki/Error_Level_Analyser on the file to produce a heat map, but nothing conclusive was seen in terms of image manipulation. There is a suspicious spot in the middle of the image, see keyboardheatmap.png but it appears that occurs from light on the subject. Additionally, used a custom python script to perform varying ELA at intervals of 15%.

beach_foot.jpg real altered image

0xB0 Canon Canon Powershot SD550 implies the image is a real photo.

0xDC Adobe Photoshop CS3 Windows 2008 implies the image was saved in photoshop and potentially altered, lots of other references to photoshop and the camera in the metadata.

See "beach_foot heatmap.png". Appears from the line on the leg that the leg was inserted in the image or altered in some way. Additionally, the heatmap image shows an unusual area at the top of the image of circular object that cannot be explained easily and which seems almost too perfect to appear in nature. Lastly in the heatmap where the shadow from the leg has an anomaly as well. This area contains black while the rest of the image has only shades of blue.

bearded_guy.jpg Fake image/ composite

0x18 The word "Ducky" is present...(the web says the word ducky comes from images created by Adobe photoshop)

0x2B "Adobe" present leads to believe the image was at least edited with photoshop, however, this image doesn't have the abundance of metadata as the other images do.

The heatmap shows distinct lines around the head and the signature in red.

When zooming in, the edge of the head has a very jagged edge, but on the transition to the shoulder, the shoulder line becomes very smooth.

blue_eyes.jpg fake digital image

0x104F "photoshop" and Creation Software under properties says Adobe Photoshop CS3 Windows

The Heatmap shows distinct perfectly straight lines and areas that do not occur in nature, which implies that this is at least altered.

board.jpg real unaltered image

this appears to be a real image taken on 5/1/2003 at 10:14AM using a Casio EX-Z3. No mention of photoshop.

bride.jpg composite image

metadata: creation software = Adobe photoshop CS3 Windows

It appears the necklace at the very least was added to the image as visible edges can be seen.

It looks like certain parts of the image are not at the same quality of the rest of the image as can be in some of the ELA tests, in particular the neclace and hair.

brunette.jpg

Canon Powershot A620 on 11/23/2005 at 4.34pm. no photoshop mentioned. It appears to be a real image but could use some color adjustment as the image is very red.

curtain_lady.jpg composite image

creation software= Adobe Photoshop CS3 Windows

It appears she was added to the picture as the image has a sort of halo around her. Looks like a touch up rather than full CG.

Additionally, by looking at the ELA images it appears that the the lady and the background image are at different levels.

eagle.jpg

canon EOS 350D Digital Camera. No mention of photoshop.

the ELA analysis is fairly inconclusive on this image as the body of the bird matches that of the sky, but the edges somewhat glow. The information from the camera seems accurate for the depth of field and lack of blur from motion.

elder_lady.jpg Fake altered image

This is definitely an altered image. I searched for the artist and found Marek Denko and his picture Clochard. The original doesn't have the black smudges around the picture. Additionally, the rest of Marek Denko's artwork is all 3-d images so it can be assumed that this image (which looks like a diarama almost) is a created image and not a real one.

girl.jpg.jpg Fake Image

metadata: creation software Adobe Photoshop CS3

First off, the face seems too elongated and almost plastic looking. When doing the ELA, the image has some blocky areas that don't seem man made.

girl_with_glasses.jpg Fake image

No metadata info in this image, but the eyes don't seem correct. It seems like they aren't connected, almost floating. Additionally, the ear is out of focus but the hair is.

guy.jpg real altered image

everything in this image seems like it is a real image, but when looking at the eyes something doesn't seem quite right. He has a large glare from a bright light on his face and jacket, yet his eyes don't have any light reflected off them. A glare falls on his upper eyelid, which could account for it.

lady_in_tshirt.jpg.jpeg

composite image

In the ELA images the head has a halo around it, but the tshirt does not. Leads me believe this is two separate images.

Leonardo.jpg

real digitally enhanced image

The picture has a few section on the heatmap that black when the rest of the image is shades of blue. The ELA doesn't reveal anything conclusive.

Sequin_girl.jpg composite image

The girl in the picture has disproportionately large eyes when compared to the rest of her features, which makes us believe it is a doll. the image has been manipulated by inserting a black border around the image with almost a bevel. This can be seen in the heatmap image really well as a red line around the image. The red line surrounding the picture is not the only suspect area of the image. In fact, all of the clothes are of the same red color. This is echoed as well in the ELA images, to include the eyes and mouth.

tulips.jpg

metadata shows the camera to be real and shot by a Canon PowerShot A520. The heatmap and ELA do not reveal anything that leads us to believe this image has been tampered with.

veiled_lady.jpg real image that has been digitally enhanced

the ELA and heatmap show an area in the upper right hand corner that is composed of blocks (most easily seen in the heatmap image).

Challenge Number: 402 - Image Analysis**Tool Information**

Type	Name	Publisher
<input type="radio"/> Commercial <input checked="" type="radio"/> Open Source	Notepad++	notepad-plus.sourceforge.net
<input checked="" type="radio"/> Commercial <input type="radio"/> Open Source	Google Picasa	Google
<input type="radio"/> Commercial <input checked="" type="radio"/> Open Source	Error Level Analyzer	www.tinyappz.com/wiki/Error_Level_Analyzer
<input type="radio"/> Commercial <input checked="" type="radio"/> Open Source	Python	Python Foundation
<input type="radio"/> Commercial <input type="radio"/> Open Source		

Notes

A few methods were used during this work. The first was a combination of exploring the metadata and looking at the image for abnormalities or areas that didn't seem natural. We tried to use lighting and examine relative proportions to some degree. However, JPEG Error Level Analysis was the main tool that we used in examining the images. At first we used a program called Error Level Analyzer from http://www.tinyappz.com/wiki/Error_Level_Analyzer that would produce a heatmap of the image in hopes of showing on portion of the image to be at a different error level than another part of an image and by doing so proving that the image is either CG, Composite or real.

However, we created a separate program based upon the description of the above using Python scripts (mistakenly called 103_image_Analysis.py). the operation of the file is as follows. The image is saved at a lower quality and then compares the RGB values of the image to the original. The amplified differences are saved to a new image to create a new image that shows change based on light and dark colors. This program repeated the comparison for levels starting at 15% quality and incrementing by 15% up to 90%.

If possible the artist was researched, where in the elder_lady.jpg image was found to be from the artist Marek Danko. This new image clearly showed some digital manipulation in the upper portions shown as black smudges, almost like tar or smoke. The other image that contained a signature was unable to be identified as the name was illegible.


```
# 103_Image_Analysis.py
# Team AWGN
# Written by Graham Eschbacher
# October 23, 2008
#
# This script opens each image in the variable "path" and performs an
# error level analysis on it. This is done by saving the original image
# at lower quality levels, and comparing the RGB values of the pixels
# of the two images. The difference in these values is amplified and
# placed into a new picture, where dark areas are pixels that changed
# little with saving, and lighter areas changed more.
#
# This script uses the Image module of the Python Imaging Library (PIL)
# available from http://www.pythonware.com/products/pil/index.htm

import Image
import os

def getdiff(a,b, m = 20):
    # save pixel data to stream of hex characters
    a_data = a.tostring()
    b_data = b.tostring()

    newdata = ''
    for i in range(len(a_data)):
        # compare pixel values - with multiplier m, value may go over the maximum of 255
        val = m * abs(ord(a_data[i]) - ord(b_data[i]))
        if val > 255: val = 255
        newdata = newdata + chr(val)

    del a_data
    del b_data

    # insert data into new image
    diff=Image.new(a.mode,a.size)
    diff.fromstring(newdata)
    return diff

def main():

    #path = r'D:\DC3\103_Image_Analysis_Challenge2008'
    #outpath = r'D:\DC3\103_data'
    path = r'/home/eeschba/Desktop/DC3/103_Image_Analysis_Challenge2008'
    outpath = r'/media/disk/103'
    delta = 15 #quality degradation amount for each iteration

    for file in os.walk(path).next()[2]:
        orig = Image.open(os.path.join(path,file))
        new_path = os.path.join(outpath,file + '_data')
        if not os.path.exists(new_path): os.makedirs(new_path)
        print file
```

```
q = 90          #starting quality level
while q > 0:
    filename1 = os.path.join(new_path, file + '_quality=' \
        + str(q) + '.jpg')
    filename2 = os.path.join(new_path, file + '_quality=' \
        + str(q) + 'diff.jpg')

    if os.path.exists(filename2):
        q = q - delta
        continue
    print file + ' - Quality = ' + str(q) + '%'

    orig.save(filename1, 'JPEG', quality=q)
    b = Image.open(filename1)

    print 'Comparing'
    diff = getdiff(orig, b, 20)
    diff.save(filename2, 'JPEG')

    q = q - delta

if __name__ == "__main__":
    main()
```